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ABSTRACT

This brief paper considers the application of "universal design" principles to Web page design in order to increase accessibility for people with disabilities. Suggestions are based on the World Wide Web Consortium's accessibility initiative, which has proposed guidelines for all Web authors and federal government standards. Seven guidelines for general page design include maintain a simple, consistent page layout throughout the site; keep background simple and with enough contrast; design large buttons; and include a note about accessibility. Examples of six guidelines for graphical and audio features are: include appropriate ALT/LONGDESC attributes for graphical elements on your page; include menu alternatives for image maps to ensure that embedded links are accessible; include descriptive captions for pictures and transcriptions of manuscript images; and provide audio description and captions or transcripts of video. Among suggestions for special Web page features are the sparing use of tables and frames; provision of alternatives for forms and databases; and provision of alternatives for content in applets and plug-ins. Finally, the paper urges developers to test the Web site with various Web browsers. Following a list of 13 resource Web sites, the paper lists contact and other information resources associated with Project DO-IT at the University of Washington. (DB)

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DO-IT

World Wide Access: Accessible Web Design

Disabilities
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The World Wide Web has rapidly become the dominant Internet tool, combining hypertext and multimedia to provide a network of educational, governmental, and commercial resources. The Web has mushroomed in popularity because it is such a powerful and versatile medium. Much of its power comes from the fact that it presents information in a variety of formats while it also organizes that information through hypertext links.

Because of the multimedia nature of the Web combined with the poor design of some Web sites, many Internet surfers cannot use the full range of resources this revolutionary tool provides. Some visitors:

- Cannot see graphics because of visual impairments.
- Cannot hear audio because of hearing impairments.
- Use slow connections and modems or older equipment that cannot download large files.
- Have difficulty navigating sites that are poorly organized with unclear directions because they have learning disabilities, speak English as a second language, or are younger than the average user.

Some people use assistive technology with their computer to access the Web. For example, a person who is blind may use a speech output system that reads aloud text presented on the screen; this system may be composed of screen reading software and a speech synthesizer. A person with a mobility impairment may not be able to use a mouse and rely on the keyboard for Web browsing. To create resources that can be used by the widest spectrum of potential visitors rather than an idealized "average," Web page designers should apply "universal design" principles. They should consider the special needs of individuals with disabilities, older persons, people for whom English is a second language, and those using outdated hardware and software.

Universal design techniques can be applied in the design of packaging, software, appliances, transportation systems and many other products and services. Examples of universal design in architecture are the inclusion of ramps and automatic door openers as well as Braille labels on elevator control buttons. Following universal design principles in creating a Web resource ensures that all Internet users can get to the information at a Web site regardless of their abilities, their disabilities, or the limitations of their equipment and software.

The Americans with Disabilities Act (ADA) of 1990 requires that U.S. programs and services be accessible to individuals with disabilities. A 1996 Department of Justice ruling makes it clear that ADA accessibility requirements apply to Internet resources.

The World Wide Web Consortium (W3C) develops the common protocols used on the Web to insure interoperability to promote universal access *(http://www.w3.org/WAI/)*. The W3C's Web Accessibility Initiative (WAI) has proposed guidelines for all Web authors. As Tim Berners-Lee, Director of the W3C puts it:

> "The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect."

In 2001 the U.S. Architectural and Transportation Barriers Compliance Board (Access Board) developed standards to which Web pages of federal agencies must comply *(http://www.access-board.gov/sec508/508standards.htm)*. The Technology Related Assistance for Individuals Act requires that the state agencies of states that accept funding under

this Act comply with Section 508. The list of guidelines for accessibility provides a good model even for organizations who are not required to comply.

The following suggestions will help you get started designing accessible Web pages. They are based on the WAI guidelines and Section 508 standards for Web content.

General Page Design

Designing a well-organized Web site helps visitors navigate through the information presented.

- **Maintain a simple, consistent page layout throughout your site.**
  A consistent design and look makes it easier for visitors to locate the specific information they seek. For example, a feature presented on every page, such as a standard navigation menu or logo for the site, should always appear in the same place. A carefully planned organizational scheme will help everyone use your site. A clear, consistent presentation will especially assist people with visual impairments or learning disabilities who have difficulty following disorganized presentations.

- **Keep backgrounds simple. Make sure there is enough contrast.**
  People with low vision or colorblindness, or those using black and white monitors, can have difficulty reading information at sites with busy backgrounds and dark colors. Some background images and colors obscure text and make reading difficult. Make sure that there is enough contrast between your text and the background of the page. Choose background, text and link colors carefully, and always test your site by viewing it at different resolutions and color depths. For example, you can change your monitor settings to a resolution of 640x480 and 16 colors for one test, and change to 1024x768 and 24 bit color for another.

- **Use standard HTML.**
  Hypertext Markup Language (HTML) is the standard code used to create Web sites. HTML was designed to be a universal format outside the bounds of proprietary software and computer operating systems. The code works via tags that tell a Web browser where to find and how to display information. While nonstandard tags exist, using standard HTML as defined by the W3C will ensure that your content can be accessed by all browsers used by visitors to your site. Avoid tags, features and plug-ins that are available to only one brand or version of a browser.

- **Design large buttons.**
  Small buttons marking links can be difficult targets for visitors with mobility impairments that result in restricted hand movements. Larger buttons can make it easier for all visitors to select the links on your page. Test how your buttons appear and operate with a variety of monitor sizes and screen resolutions.

- **Caption video and transcribe other audio.**
  Multimedia formats that include audio can present barriers to people with hearing impairments as well as to people with less sophisticated computer systems. Provide captions and transcriptions for these resources so visitors who cannot hear have an alternative method for accessing the information.

- **Make links descriptive so that they are understood out of context.**
  Visitors who use screen reading software

can adjust their software to read only the links on a page. For this reason, links should provide enough information when read out of context. Use a more descriptive phrase than "click here" as a link or next to a graphic used as a link. For example:

```
<A HREF="./about.htm">Click
here</A> for information about
our company.
```

will present "Click here" as the link. However,

```
<A HREF="about.htm">
Information about our company.
</A>
```

will display "Information about our company." as the link text.

- **Include a note about accessibility.**
  Notify site visitors that you are concerned about accessibility by including a Web access symbol on your page (see Resources list). Include a statement about accessibility and encourage them to notify you with their accessibility concerns. For example, the DO-IT home page includes the following statement:

  ```
  The DO-IT pages form a living
  document and are regularly
  updated. We strive to make them
  universally accessible. You
  will notice that we minimize
  the use of graphics and photos,
  and provide descriptions of
  them when they are included.
  Video clips are open-captioned,
  providing access to users who
  can't hear the audio. Sugges-
  tions for increasing the
  accessibility of these pages
  are welcome.
  ```

Graphical and Audio Features

People who are blind cannot view the graphical features of your Web site. Many people with visual impairments use speech output programs with nonstandard browsers (such as pwWebSpeak or Lynx) or graphical browsers with the feature that loads images turned off. Include text alternatives to make the content in graphical features accessible. Described below are guidelines for providing alternative text for various types of visual features.

- **Include appropriate ALT/LONGDESC attributes for graphical elements on your page.**
  ALT attributes work with HTML image tags to give alternative text descriptive information for graphical elements of a Web page. The alternative text helps visitors understand what is on the page if they are not viewing the graphic. This could be because they are blind and using a text-based browser or a graphical browser with the image loading feature turned off. The bold text in the following example shows what an ALT attribute looks like in HTML:

  ```
  <IMG SRC="./doitlogo.large.gif"
  ALT="[DO-IT LOGO]">
  ```

  When a sighted visitor views the page with a graphical browser, he will see a picture of the DO-IT logo. When someone who is blind visits, his voice output program will read **[DO-IT LOGO]**. This gives him a clear idea of what is on the page. In addition, any visitor coming to the site using a text-based browser will understand that there is a DO-IT logo there instead of the more ambiguous "image," the default result when no ALT attribute is used. ALT attributes should be short (less

than 5 words) since browsers sometimes have difficulty displaying lengthy ALT text.

When using text to describe complex graphs or charts, or to transcribe sound files containing speech or lyrics, summarize the information next to the element, or consider using the LONGDESC attribute which provides for more detailed text than ALT. Lengthy descriptions can also be linked to an external document or immediately follow the graphic or sound element.

- **Include menu alternatives for image maps to ensure that the embedded links are accessible.**
In an image map (also called ISMAP), a part of a picture can be clicked to activate a link to another page. For example, on a map of the United States, a visitor might click on an image of the state of Oregon to find information about the state. If the Web page developer has not included an alternative menu, visitors using text-based browsers can be totally blocked from the site, or sent on a wild goose chase clicking unlabeled links. The following example does not include an alternative menu for the image map.

```
<HTML>
<TITLE>Our Library Page</TITLE>
<BODY>
<A HREF="home.map">
<IMG SRC="images/home.jpg"
ISAMP>
</A>
</BODY>
</HTML>
```

When viewed through a graphical browser such as Netscape Navigator™ or Internet Explorer™, a beautiful picture of a floor map of a library appears. The visitor can choose selected areas of the library to view. When a visitor using a text-based browser visits the site, this is what he sees:

```
Our Library Page
[ISMAP]
```

At this point the visitor is stuck, because text-based browsers will not interpret the hypertext links embedded in the image map. His only option is to back out of the site. A visitor who uses a text-based browser, perhaps because he is blind, can't get to your information unless an alternative is provided. The accessibility of an image map depends on the software used as a Web site's server. Check with your system administrator to find out about the capabilities of your Web server software. Some server software will automatically render text links for image maps while other versions won't. Providing text alternatives to image-based links will ensure image maps are available to the widest audience.

- **Include descriptive captions for pictures and transcriptions of manuscript images.**

Providing ALT text for an image is sufficient for logos and graphics that contain little information content. However, if the graphics provide more extensive information, adding captions and transcriptions is important for those who cannot see your page because they are using a text-based browser or they have turned off the graphics loading feature of their browser. This includes people who are blind. If you are not sure how critical a particular image is to the content of a page, temporarily remove it and consider the impact of its loss.

If you present information in an image format, such as a scanned-in image of a page of a manuscript, be sure to also provide a transcription of the manuscript in a straight text format. This alternative is useful for many visitors, including those with visual impairments and those with learning disabilities who may have difficulty reading the original document.

- **Use a NULL value for unimportant graphics.**
  Some graphical elements may add no content to a page and can be bypassed from viewing by using an ALT attribute with no text. By using just two quotation marks with no content, you can reduce the amount of distracting text when a page is viewed with graphics capabilities turned off or with a text-based browser. For example, the HTML for a divider bar could be:

  ```
  <IMG SRC="./purplebar.gif"
  ALT="">
  ```

  Sighted visitors will see the divider bar, while those visiting via a text browser will see/hear nothing.

- **Provide audio description and captions or transcripts of video.**
  If your multimedia resources provided on your site include video, people who can not see will be unable to use this information unless it is provided in an alternative format. A text transcription provided with the video will give a visitor who cannot see, or who doesn't have the appropriate viewing software, access to the information in your video clip. Captions and transcripts also provide access to the content for those who cannot hear.

- **Consider other options for making graphical features accessible.**
  Some Web designers make an image accessible by placing a hyperlink "D" (for description) immediately before or after an image that links to another page with an image description. At the end of each description another hyperlink returns the user to the original page. This method should be used with caution as it can add unnecessary navigational complexity to the site.

  Some organizations with graphic-intensive Web pages provide a separate text version of their site to ensure accessibility. This adds maintenance time and complexity because two versions of a site must be updated. It also segregates site visitors according to the type of equipment they use to access the Web. As much as possible, design a single version of your site so that it is accessible to all visitors.

Special Features

- **Use tables and frames sparingly and consider alternatives.**
  Most screen reader programs read from left to right, jumbling the meaning of information in tables. Some blind visitors can interpret tabular information, but it is best to look for other ways to present the information to ensure that visitors with visual impairments can reach your data. In the same vein, frames can be difficult for text-based screen reading software to access. Evaluate whether frames are truly necessary at your site. When frames are used available, ensure that frames are labeled with the TITLE attribute, provide a text alternative with NOFRAMES, and use the TARGET = "_top" attribute to ensure useful Uniform Resource Location (URL) addressing is provided for each interior frame.

- **Provide alternatives for forms and databases.**
  Some combinations of browsers and screen readers encounter errors with nonstandard or complex forms. Always test forms and databases with a text-based browser. Include an e-mail address and other contact information for those who cannot use your forms or database.

- **Provide alternatives for content in applets and plug-ins.**
  As future versions of software develop, applets (such as programs created with JavaScript™) and plug-ins (such as Adobe Acrobat™) may provide accessibility features. However, many of these programs are currently not accessible to people using text-based browsers. To ensure that people with visual and hearing impairments can access your information, provide the content from these programs in alternative, text-based formats. When using JavaScript, make sure to employ the built-in accessibility features within the Java Developer's Kit.

Web Pages Test

Test your Web site with a variety of Web browsers, and always test your pages with at least one text-based browser and with multimedia browsers with graphics and sound-loading features turned off. This way you will see your Web resources from the many perspectives of your users. Also view the resources at your site using a variety of computer platforms, monitor sizes, and screen resolutions. Make sure you can access all of the features of your web site with the keyboard alone; this test simulates the experience of web users who cannot use a mouse. Make use of a accessibility testing software such as A-Prompt, Bobby, and WAVE; they will point out elements that could be inaccessible. Revise your HTML to make your site accessible.

Resources

A-Prompt
http://aprompt.snow.utoronto.ca/

ADA accessibility requirements apply to Internet Web pages. (1996). The Law Reporter, 10(6), 1053-1084.

Americans with Disabilities Act of 1990
http://www.usdoj.gov/crt/ada/adahom1.htm

Bobby, CAST (Center for Applied Special Technology)
http://www.cast.org/bobby/

DO-IT (Disabilities, Opportunities, Internetworking and Technology) - Accessible Web Page Design
http://www.w[illegible]ngton.edu/doit/Resources/web-design.html

EASI (Equal Access to Software and Information)
http://www.isc.rit.edu/~easi/

International Center for Disability Resources on the Internet
http://www.icdri.org/

Java accessibility resources
http://www.sun.com/access/

National Center for Accessible Media (NCAM) resources
http://ncam.wgbh.org/

Section 508 Standards of the Access Board
http://www.access-board.gov/sec508/508standards.htm

Trace Research and Development Center
http://www.trace.wisc.edu/

WAVE (Web Accessibility Versatile Evaluator)
http://www.temple.edu/inst_disabilities/piat/wave/

W3C's Web Accessibility Initiative (WAI)
http://www.w3.org/WAI/

World Wide Access Videotape

A 11-minute videotape, *World Wide Access: Accessible Web Design*, introduces accessible Web design and may be purchased by sending $25 to DO-IT. You will receive an open captioned as well as an open captioned and audio described version. Permission is granted to reproduce DO-IT videotapes for educational, non-commercial purposes as long as the source is acknowledged.

Grants and gifts fund DO-IT publications, videotapes, and programs to support the academic and career success of people with disabilities. Contribute today by sending a check to DO-IT, Box 355670, University of Washington, Seattle, WA 98195-5670.

Your gift is tax deductible as specified in IRS regulations. Pursuant to RCW 19.09, the University of Washington is registered as a charitable organization with the Secretary of State, State of Washington. For more information, call the Office of the Secretary of State, 800-322-4483.

About DO-IT

DO-IT (Disabilities, Opportunities, Internetworking, and Technology) serves to increase the successful participation of individuals with disabilities in challenging academic programs and careers, such as those in science, engineering, mathematics, and technology. Primary funding for the DO-IT program is provided by the National Science Foundation, the State of Washington, and U.S. Department of Education. This publication was developed with funding from the National Science Foundation (grant #9800324). However, the contents do not necessarily represent the policy of the federal government, and you should not assume their endorsement. For more information, to be placed on the DO-IT mailing list, or to request materials in an alternate format, contact:

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